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quoted by Drs. Hayden and Aughey from the loess of Nebraska. There are thus, of mollusks, eleven genera attributed to fresh-water, against thirteen genera to land forms. The single exception to varieties now living, as above noted, is *Helicina*, the species meant, *H. occulta* Say, being now extinct.¹ It may be properly considered the only species characteristic of the loess. From the loess of east Central Iowa, at Iowa City, the *chela* of a *Cambarus* is reported,² under circumstances which leave no doubt that it is from *true* loess.

Of higher animals there have been found, especially in the Southern States, remains of *Mastodon*, *Megatherium*, *Myiodon*, *Megalonyx*, *Castor*, and *Fiber*, among others. Their remains and the relation of the loess to the drift, which, when both are present, it always covers, places its epoch at the close of the glacial period.

(*To be continued.*)

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ICHTHYOLOGICAL PAPERS BY GEORGE POWERS DUNBAR, WITH A SKETCH OF HIS LIFE.

BY JACOB L. WORTMAN.

A STUDY of the fishes of the Southern States is one replete with many points of interest for the naturalist, and had it not been for a series of misfortunes, the credit for the earliest research into this field would probably be due to an American student now unknown. It is the object of the present article, to give some information relating to the life and labors of this meritorious naturalist, which are of especial interest, since he was one of the first native-born Americans who made an extended study of the ichthyology of this region. The absence during his time of any periodical devoted to the natural sciences in this country, contributed much to his disadvantage, and as a consequence the technical descriptions were withheld in anticipation of an opportunity to publish. This unfortunate circumstance is one of the causes of his obscurity, and is in part answerable for the loss of his many excellent observations in this branch.

George Powers Dunbar was born in Baltimore, February 11th, 1812. Nothing of unusual interest was noticeable in his early childhood, except an innate love for a study of natural history, on

¹ This statement now needs some modification. Since it was in type, a species of *Helicina* has been sent me in considerable abundance, taken in the vicinity of Iowa City. That they are *H. occulta* Say, is hardly to be doubted. The forms sent all approximate the variety described by Green as *Helicina rubella*.

² A. H. Pilsbury, *in litt.*

account of which his parents were doubtful of his future success in life. He entered St. Mary's College, Maryland, at an early age, and graduated from it with high honors in his eighteenth year. The unfavorable outlook that science then presented for a livelihood, induced him to look elsewhere for means of support. Civil engineering was the profession that he chose, and the one that he practiced until his death. Having completed his studies in this branch, he was engaged on a survey of the Baltimore and Ohio, and the Portsmouth and Roanoke railroads from 1829 to 1835, a station on the former line still bears his name. In the early part of 1835, he removed to New Orleans, where he was employed on the Nashville railroad under Major Ranney. He was appointed Engineer of Public Works of the State in 1837, which office he held until 1842, when he was elected surveyor of the second municipality. This last office he retained with the exception of a few months till the time of his death, which occurred on December 29, 1850, at the mouth of the Coatzacoalcos river, Mexico. Although in feeble health, Mr. Dunbar had accepted a position with a corps of engineers, to survey the route for the Tehauntepec railroad, where his health gave way entirely, and he died on shipboard while en route to his home in New Orleans.

At the early age of nine, he began collecting and arranging in systematic order entomological specimens. In the course of a few years his collections on this subject amounted to several thousand specimens, which he afterwards presented to Dr. Luzenburg, of New Orleans. The collection was afterward destroyed for want of proper care. He was likewise familiar with the Flora of the South, and contributed something on the "Flora of the Dismal Swamp." Shortly after leaving college, he began a careful study of the classification, structure and habits of the fishes of the Southern States, which he continued with great zeal up to the time of his death. All the time that could be spared from his professional duties was given to the pursuit of his favorite study, and he had prepared nearly all the plates and texts for an extensive volume which he was intending soon to publish. The volume was to contain descriptions of over one hundred fishes, and was to be profusely illustrated by drawings from life made by himself. His last observations on some of the fishes of the Mexican coast, made a short time previous to his decease, are still in existence and were probably the last that he intended to make before publishing his work. In connection with his sad and untimely death we are

called upon to chronicle another most lamentable fact, the utter destruction of his manuscript by fire at Riesterstown, Maryland, a few years afterwards. His friends intended to publish his work, but deferred publication in the hope that his son would take up the subject and finish what his father had so nobly begun. The son, however, had no inclination for such study, and the publication was too long delayed. The notes above referred to, a small field book containing drawings and descriptions of twenty species of fishes, together with some popular descriptions that were published in various newspapers, are all that remain of his labors in this field. These are the property of his eldest daughter, wife of Dr. W. H. Corbusier, Asst. Surg. U. S. A. Although the subject has been carefully developed by subsequent students, yet our respectful esteem is due to the merits of this pioneer naturalist, whom misfortune has cast into the shadow of obscurity. It is unfortunate in the extreme that death should have cut short his career, and the result of his close and careful observations should have been swept away at a flash. That he possessed true merits is observable by a glance at his remaining notes, which likewise serve to indicate the excellence of his intended publication.

I give some extracts from his MSS. which will prove interesting and novel even to ichthyologists.

I. The Alligator Gar (Litholepis spatula Lac. Jor.).—But few of my readers except those who have resided in the South, have an idea of the alligator gar, and for their benefit I will describe this river robber. The body is cylindrical and elongated, and completely enveloped in a strong coat of mail, formed by strongly toothed quadrangular plates lapping over each other, and held by an exceedingly thick and tough skin. The head is elongated, with a flattened obtuse snout, something similar to that of a pike, and armed with several rows of strong pointed and trenchant teeth, the outer row being much larger than the inner ones. The bones of the head are naked, and form a series of stout plates. So hard is the armor with which this fish is enveloped, that no arm, however strong, can penetrate his back with an axe, and it is only by cutting him in his throat or by a blow on the back of the head that he can be killed. They grow to an immense size, being often seen in the waters of the Mississippi twelve or fourteen feet long, and sometimes reaching a weight of several hundred pounds. He is possessed of prodigious strength, and sets at defiance the

efforts of the uninitiated angler, swallowing his hooks by the handful and parting his tackle as if it were pack thread.

This remarkable fish is familiar to almost every resident in the South, and yet but little is known generally of its habits and history. His terrific jaws, his flinty scales, and the extreme difficulty of hooking him, the ease with which he destroys the ordinary tackle used by the angler, added to his worthlessness for the table, render him an object of terror to the fisherman, which added to his fierce and repulsive appearance, is sure to obtain for him, should he by any means fall into his hands, such treatment as his namesake, the alligator, might expect from the huntsman whose dog had been devoured by the monster.

Possessed of an exceedingly ravenous appetite, he snaps at and devours every thing which comes in his reach, and yet there are times when the most dainty morsel will scarcely tempt him. Early in the morning the water is continually broken by him as he rises to seize the floating insects, or small fish swimming upon the surface; but, as the sun ascends, if on the feed, he takes to the deeper water, slowly moving along in search of his prey, and occasionally rising and rolling on the surface in sport. Tired of the chase, he may be seen basking his huge and motionless form in some sunny nook, the shoals of mullet frisking and frolicking around him unheeded. Rapid, current or pool, the clear running spring stream, the sluggish bayou, the pond, or the salt creek, all are familiar to him, but he particularly affects the deep still bayou, or the entrance of some sluggish stream into a bright, clear and dashing current. Stand on the little bar formed by the junction of the last mentioned, and you may see him pass and repass, plunging into the current after a small fish, diving under the rooty bank, and rolling in fun on the top of the dark bayou, and snapping his jaws together, as if the livelong day were only created for him to rollick in. The ringing steel launched from the sturdy arm of the fisherman glances harmlessly from his more than steel-clad body, the river robber rolls his huge form through the deep river, now rising like a porpoise, and now with noiseless movement of a cat swimming slowly to the shallows, stealing along through the bright green leaves of the beautiful nelumbium to surprise the sunny perch or sleeping pike, or suddenly attracted by a passing shoal of sardine or mullet, he dashes like light to their center, his capacious and horrid jaws

wide open and his sinewy tail dealing death on every side. The wary bass retires to his shady nook, and the little patasa dive deeper into their rooty recesses at his approach, and woe betide the unlucky wight who trails his well filled string of bass at the stern of his pirogue ; the river robber is sure to attempt a rescue, and well will it be for the angler, as seizure once made, if he have a single fish left, of his morning's sport.

During the months of December and January the fish seek the heads of the still and almost stagnant bayous or the deep caves of the sluggish rivers to deposit their spawn. The eggs are held suspended in a thick gelatinous transparent substance, forming long ropes several inches in diameter, which are hung on old snags, roots or branches of trees that have fallen into the water. The spawn has much the appearance of that of the frog, with the exception of the circular form it assumes, and the size of the eggs, which are about as large as No. 4 shot, and of a dark purple color. The young come forth during the spring, and tiny little rascals they are, but they grow with astonishing rapidity, and by the latter part of August are some fourteen inches in length and weigh several ounces ; in one year they reach a weight of from nine to twelve pounds, and go on increasing to several hundreds. Large numbers of these fry are destroyed by other fish, and well that it is so, otherwise no fish could live in any of the rivers for them, the ovaries of a large fish containing several hundred thousand eggs.

Well skilled are ye, my piscatory brethren of the North, in the art of killing trout and salmon, rock and pickerel, and truly you have beautiful customers to deal with, but I would put you with your Conroy's and your plaited silk, at a sixty pound Poipon D'Armée, and in an hour you would be hookless, lineless and rodless, and only have for satisfaction that you had seen the lazy hulk roll his huge form in sport over the surface. Few of you would come off victorious in your first day, but when you became acquainted with your customer, and learned the necessary rigging, then would the armed monster repent of his appetite for mullet or sardine.

Although I have taken many small gar, from twenty to thirty pounds, with a light fly rod and a single gut, yet I never fish for them with such tackle, for where you succeed in striking one in a tender place and beyond the reach of his tremendous jaws, you

will break your gut a hundred times. No! I go upon the safe, the sure principle of saving my fish, and I use tackle accordingly. My ash and hickory (I cannot yet boast a Conroy, but I will soon) are laid aside, and a three-joint cane, with a stout tip substituted in their place; instead of rings my line passes through small becketts *on top of* the rod and over a roller at the tip. My line is generally manilla or sea grass of fine size. I prefer it as such a large quantity can be placed upon the reel. But the main point is the arrangement of the hooks, which is as follows: A brass or copper wire about four inches long with an eye at one end holds the bait hook. The line is made fast to a double wire passing through this eye and bent outwards, with two stout sharp hooks to each end with their points inwards, so that the fish when he takes the bait must have his throat directly above them. When the bait is taken, a strong strike is made and the consequence is that the gentleman has the hooks driven deep into either side of his throat.

The bait is overboard and every one waiting anxiously to see the "gar killer" strike his fish. The blue float slowly moves off and gradually sinks; he's there. Quietly the line is paid from the reel until he has gone some thirty feet. The hooks are driven home, the cane bends to the pressure but the line does not move. "You're fast to a log," cries one who never saw a gar. The line is slacked—another strike; another—he feels the steel and off he goes. Now for it! Full well does the gar killer know the exact pressure which his tackle will bear, and as well does he know that he can conquer only by making his prey fight and struggle for every inch of line. He whips him to his work, and now the robber has thrown off all his lethargy and tries every art, lays out all his strength to rid himself of the toils—beware his rush, for salmon or rock never came near it. Whiz goes the reel; twenty yards are gone, and you have him. Now comes the struggle and the angler is victorious, his head is turned, and rapidly comes the line to the reel. Half an hour is gone and yet his form has not been seen. Do you see the line slowly ascending? Watch him well, 'tis his last attempt—defeat him and he is safe. Slowly the white line leaves the water. Now faster the spray is thrown far and wide, and high in the air leaps the victim, hoping by his huge weight to break the tackle. Down goes the tip, the line is slack as he leaves the water, and his last

attempt is abortive. Weaker and weaker are his struggles; he rolls and tumbles in the water as he is slowly drawn up; the gaff is in his gills; one haul, and he's beached.

II. *The Grande Ecaillé* (*Megalops thrissoides* Bl).—In shape the head of the grand ecaillé is similar to the shad, but his mouth is much larger in proportion to the size of the fish, and his body is covered with large splendid silver scales, fitting like plated armor; those of a fish five feet long being about two inches in diameter, and showing at each intersection about a quarter moon. His tail is large, broad and stout, and he sometimes grows to a length of eight and a-half or nine feet, but generally runs from three to seven. I record the killing a grand ecaillé with a rod and reel as the greatest piscatorial feat I ever performed, which is saying a good deal after successfully playing and killing two fish, each over twenty-five pounds, with two rods and reels at the same time. I could never have killed the grand ecaillé, however, with the tackle I used, had I not been in a pirogue with a sure and steady arm at the paddle, which gave me the advantage of running on him.

In point of beauty, activity and strength, the grand ecaillé is excelled by none of the finny tribe which have come under my observation. He belongs to the same family with the shad, herring, etc., and is the king of his tribe. He scorns the seine, and generally puts at defiance the efforts of the angler. Calmly he swims around the netted prison, seeking quietly to escape from the toils, but finds no outlet, with a quiet turn of the tail he goes slowly back to the center of the net—swiftly flies the foam from his vigorous tail; with one long sweeping, graceful bound, high above the floating corks he passes, and plunges with the grace and ease of an accomplished diver, head foremost into the green wave beyond; or if by chance he becomes entangled in the bag, he gathers his immense strength together, and like the tiger springing on his prey, he rushes at the end of the bag, the corks quiver for a second, and the next instant sees the silvery meteor passing like a ray of light through the atmosphere, he quivers his broad forked tail in triumph, and laughing at the weak net, goes on his way rejoicing. See him struck by the hand line of the sturdy coastman; every inch of line is given to him and the fisherman braces himself for the pull; well for him that his hands are hard; the moment he finds himself checked in his rush, he

leaves the water and springs some ten feet into the air, shaking himself violently with the hope of casting off the hook, which he will do unless it is firmly fixed deep in his mouth, or tear off his jaw in the attempt. Another leap, another and another, with all the frenzy of the wild horse when he first feels the lasso, he springs through the air and dashes through the water; for a time there appears to be no diminution of his immense strength, but you may notice that after a while the long curve he at first described in the air becomes broken, shorter grow the graceful leaps, and finally change into a violent jerking summersault—then all is calm. The fisherman pulls on the line; one last glorious effort of those splendid powers is made—right in a line with and towards the fisherman; the grande ecaillé takes his last leap, and falls helpless into the sea. Now a child can take him without resistance—no struggling, a dead weight upon the line, he is hauled upon the beach. He flounders not, his fins are laid to his body, his gill covers do not move, he is dead! And not until death came upon him did the mighty and beautiful creature surrender himself to the superior robber.

I have often seen a school of red fish knocking the mullet into the air. I have seen troops of flying fish retreating from the lovely dolphin, I have heard for miles the roar of an immense company of mullet flying in short, regular leaps before a herd of porpoises, or a family of sharks, by whose giant forms I have seen the sea beaten into bubbles, as they lashed and struck among the frightened mullet, from my boyhood up. I have seen man prey upon his fellow-man, but never has it fallen to my lot to witness so magnificent a sight of the strong preying upon the weak as that presented by the grand ecaillés. The yellow rays of the setting sun would glance upon the silver armor of a thousand forms leaping in every possible direction, crossing and recrossing, yet never striking, the air was filled with the small sardine thrown from their native element to be devoured as they touched the water, the green gulf was lashed into a sea of foam, and the bright rainbows were everywhere visible in the scene. We passed through them many times, hoping that one might leap into the boat, caught them by the tails as they swam slowly by, and cursed our lot that we had brought no harpoon. It was a brilliant sight—one which in all probability had not been seen on so grand a scale before, as they rarely run more than three or four together, and one which it may be my lot never to witness again.